

REMARKS

Applicant thanks the Examiner for the acknowledgement of the Claim for Priority under 35 U.S.C. § 119 and receipt of the certified copies of the Priority Document(s).

The Examiner objected to the Specification as having an improper Abstract of the Disclosure. Since Applicant has included a substitute Abstract of the Disclosure herewith, this objection can now be withdrawn.

Applicant thanks the Examiner for the copy of the guidelines for the preferred layout of a utility application specification, but chooses to maintain the current specification layout

As mentioned above, the Examiner objected to the drawings as not showing all elements of the claims. The amendments to the claims place the claims in proper method form and should thus obviate the need for substitute and/or additional drawings.

The Examiner objected to claims 2-7 as failing to limit a previous claim, being in improper multiple dependent form, and/or improperly using parentheses. The amendments to the claims should also obviate these objections.

Further, the Examiner rejected claims 1-3 under 35 U.S.C. § 112, ¶ 2, as being replete with indefinite, functional, and/or operational language. The amendments to the claims eliminate and/or correct these deficiencies and should therefore obviate the Examiner's rejection.

The Examiner further rejected claims 1-3 under 35 U.S.C. § 103(a) as being unpatentable over Igarashi *et al.* (U.S. Patent No. 4,532,464) in view of Bose *et al.* (U.S. Patent No. 5,811,957). Applicant traverses this rejection and respectfully submits that the present invention is not disclosed or suggested by this combination of references, and that the Examiner has not established a *prima facie* case for obviousness.

The Examiner states that Igarashi *et al.* disclose an induction motor operating under an applied null frequency and that Bose *et al.* disclose sensorless control and that it would have been

obvious to use the sensorless control of Bose *et al.* for improved control and reliability. However, the Examiner points to no section of Bose *et al.* that provides this motivation. Further, Igarashi *et al.* deals only with a control apparatus for an induction motor that includes a speed detecting unit 8 (see FIG. 4) and is thus not actually sensorless. Thus, the Igarashi *et al.* control apparatus does not have the problem of motor speed determination during null applied frequency because the speed is measured directly by the speed detecting unit and there is no need for the substitution the Examiner suggests. The portion of Igarashi *et al.* to which the Examiner cites merely explains what frequency conversion is: an apparatus that "is construed as changing the null frequency (i.e. the D.C. input) into an alternating current of predetermined frequency (i.e. A.C. output)."

Bose *et al.* deals with a sensorless application, but does not determine motor speed with feedback measurement during null applied frequency as is required, for example, by claim 1. Igarashi *et al.* does not save Bose *et al.* from this failure. Bose *et al.* simply discloses an apparatus and method for motor control in a feedforward manner in which a continuous measurement of three phase terminal voltage and current signals is used to estimate torque and flux in the motor. Bose *et al.* disclose no feedback based determination of speed as required, albeit in slightly different language, in, for example, claim 1. In particular, Bose *et al.* fails to disclose very low and null frequency motor speed determination based on neutralization of null frequency currents to produce a transient configuration of back electromotive forces according to proper scheduling as disclosed in the instant application.

Inasmuch as all elements of, for example, instant claim 1 are neither disclosed nor suggested by the references alone or in combination, no *prima facie* case has been made, the rejection can be withdrawn and the claims can be allowed.

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In view of the foregoing remarks, the subject application is believed to be in condition for allowance. Therefore, further consideration and allowance of the subject application is requested. If the Examiner considers personal contact advantageous to the disposition of this case, please call

Applicant's Attorney, David E. Henn at (585) 325-4618, SHLESINGER & FITZSIMMONS, Rochester, New York 14604, or fax him at (585) 232-5997.

Respectfully submitted,

A handwritten signature in dark ink, appearing to read 'D. Henn', is written over a horizontal line.

SHLESINGER & FITZSIMMONS

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DEH/kmh

CLEAN COPY OF THE CLAIMS:

1. [CURRENTLY AMENDED] A sensorless induction motor speed measuring method comprising operating the motor under an applied null frequency status, measuring electric effects on phase voltages induced by a step transition between two levels of a static stator current phasor and analyzing the electric effects to determine the rotor speed.

2. [CURRENTLY AMENDED] The method of claim 1 wherein, under a control loss status, the static stator current phasor passes from a frequency in which control has been lost to an applied null frequency status in which a stator current phasor unmovable in space is applied, and measuring electric effects further comprises exploiting a following step transition towards a different stator current phasor width.

3. [CURRENTLY AMENDED] The method of claim 1 further comprising placing an electric vehicle, actuated by an induction motor, on a grade, releasing an accelerator of the vehicle, and activating, upon an applied null frequency status, a cyclic check procedure of adequacy and usefulness of the stationing phasor versus time by repeatedly measuring motor speed.

4. [CURRENTLY AMENDED] to the method of claim 3 further comprising degrading a stationing current with a small slope by cyclically verifying adequacy and usefulness of decreasing current levels by repeatedly measuring motor speed.

5. [CURRENTLY AMENDED] The method of claim 4 further comprising, when the stationing current results are not adequate, recovering motor control by applying a frequency that corresponds to the measured speed and decreases the frequency towards a low frequency value to accompany the motor along the descent.

6. [CURRENTLY AMENDED] The method of claim 5 further comprising going to an applied null frequency status when a sign of the torque developed during the low-frequency controlled descent goes from negative, corresponding to braking, to positive, corresponding to motive, at a descent end.

7. [CURRENTLY AMENDED] The method of claim 2 further comprising, when the induction motor is under a control loss status having high slip and low motion torques, recovering motor control by applying a frequency corresponding to the measured speed and then delivering control to a line algorithm, and modulating a re-tuning value frequency towards a value controlled by an accelerator.

ABSTRACT

Sensorless control of an induction motor, such as for electric vehicles, in which the speed of an induction motor is determined without encoders or other shaft transducers. When the applied frequency is null, the injection of a triad of direct currents in the stator phases supplies a stationing torque that is opposed to motion. The maximum stationing torque depends on the injected current width. It can be too low, such as if the vehicle is loaded and/or on a grade, or too high if the vehicle is on a plane. With embodiments, one can monitor, at defined time intervals, the speed of the vehicle when the applied frequency is null and with which such dichotomy can be solved. Embodiments can be applied generally to every occurrence of vehicle control loss in order to carry out its efficient recovery in line.